REMARKS

In response to the Office Action dated 25 April 2002, claim 15 has been canceled without prejudice or disclaimer and claims 1 and 14 have been amended. Claims 1-14 and 16-26 are pending in the case. No new matter has been added. Reexamination and reconsideration of the claims as requested is respectfully requested.

On pages 1 and 2 of the Office Action, Figs. 1-3 were objected to because they are not designated as *PRIOR ART* and fail to include reference signs, and Fig. 5 was objected to because of confusion with a label. Also, according to the Office Action, the drawings were objected to for failing to comply with 37 C.F.R. §1.84(p)(4) because of ambiguous reference characters.

Applicants respectfully traverses the objection, but in the interest of expediting prosecution have submitting new Figs. 1-3 and 5 under separate cover entitled PROPOSED DRAWINGS. New Figs. 1-2 now includes the legend "prior art." New Figs. 3 and 5 now includes corrected reference signs. Applicants submit that reference signs were also corrected in the Specification. Applicants respectfully submit that the changes to Figs. 1-3 do not include new matter. Further, Applicants' respectfully submit that Fig. 3 describes data migration according to the present invention, and thus, is not prior art.

Therefore, in view of the above remarks, Applicants respectfully request that Examiner withdraw the objections. .

On pages 3 and 4 of the Office Action, the Specification was objected to because the Figures included labels that were not shown in the Specification.

Applicants respectfully traverse the objection, but in the interest of expediting prosecution have amended the Specification as suggested by the Office Action.

With respect to the term "digital array storage device(s)," Applicants respectfully submit that an acronym for this term was not used in the Specification. Further, the acronym DASD was only defined for "direct access storage devices", and was only as representing "direct access storage devices." Thus, Applicants submit that the term "digital array storage device(s)" is not misleading as compared with the acronym for a "direct access storage devices (DASD).

With respect to the term "52x," Applicants have provided a brief definition of the term in the Specification as requested by the Office Action.

Therefore, in view of the above remarks, Applicants respectfully request that Examiner withdraw the objections.

On page 4 of the Office Action, claims 3, 8, 16, and 21 were objected to because the term re-laying should be defined in the claims or Specification and claim 15 was objected to as being of improper depended t form. Applicants respectfully traverse the rejection, but in the interest of prosecution have defined the term in the Specification as suggested by the Office Action, and have also cancelled claim 15 without prejudice or disclaimer.

Therefore, in view of the above remarks, Applicants respectfully request that Examiner withdraw the objections.

On page 5 of the Office Action, claims 1-5, 7,14-18, 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schultz et al US Patent 6,058,489 in view of Ofer et al. US Patent 5,887,199. According to the Office Action, Schultz

discloses adding at least one drive to a system controller. However, according to the Office Action, Shultz does not disclose the converting data in a first format type on the digital array of storage devices to a format of a second type on the added at least one drive. Nevertheless, according to the Office Action, Ofer discloses a disk array where each drive may have its own block size (format).

Therefore, according to the Office Action, it would have been obvious to one skilled in the art at the time of invention to add a drive of one format to a disk array of a different format.

Applicants respectfully traverse these rejections. Applicants respectfully submit that the cited references, taken alone or in combination, do not disclose, teach or suggest the invention. Applicants respectfully submit that there are patentable differences between the cited references and Applicants' invention as recited in the claims. Applicants' invention differs from the cited references in at least the following respects.

Applicants' invention requires adding at least one drive to a system controller controlling a predetermined number of storage devices arranged in a digital array storage devices to form a system drive. Further, Applicants' invention requires converting data in a first format type on the digital array of storage devices to a format of a second type, the converted data being migrated onto the added drives.

As admitted by the Office Action, Schultz fails to disclose at least converting data in a first format type on the digital array of storage devices to a format of a second type, the converted data being migrated onto the added at least one drive. Rather, Schultz merely discloses a system disk controller performing on-line

reconfiguration when expanding Redundant Arrays of Inexpensive Disks (RAID) arrays. Schultz does not even consider converting data in a first format type to a second format type when migrating data from the original RAID to the expanded RAID.

Ofer fails to remedy the deficiencies of Schultz. Ofer fails to disclose at least adding at least one drive to a system controller controlling a predetermined number of storage devices arranged in a digital array storage devices to form a system drive. Further, Ofer fails to disclose converting data in a first format type on the digital array of storage devices to a format of a second type, the converted data being migrated onto the added at least one drive.

Rather, Ofer merely discloses a disk drive controller for receiving and sending data. Ofer receives data blocks of preselected varying sizes from a host computer. (Abstract). Further, Ofer discloses that the disk controller "requires" an identification of the input system from where the data is received. (col. 4, lines 2-5). Then, the incoming data stream from the identified system is formatted for a particular disk drive on the controllers system. (col. 3, lines 23-35).

Thus, Ofer is different from Applicants' invention because Ofer does not consider migrating converted data from a system drive formed by a system controller controlling a digital array of storage devices and at least one additional drive, to the at least one additional drive controlled by the same system controller. In other words, Ofer does not even consider migrating data from Ofer's own drives by converting data in a first format type on the drives to a format of a second type.

Therefore, in view of the above remarks, Applicants' independent claims 1 and 14 are patentable over Schultz and Ofer.

In addition, it is submitted that further consideration of claim rejections under 35 USC 103(a) upon the citing of the third applied prior art reference to Stallmo is moot, inasmuch as the combination of Schultz, Ofer and Stallmo still lack any teaching, disclosure, or suggestion concerning converting data in a first format type on the digital array of storage devices to a format of a second type and migrating the converted data onto the added drives as previously discussed.

Therefore, in view of the above remarks, Applicants' independent claims 1 and 14 are patentable over Schultz, Ofer and Stallmo.

Because claims 2-13 and 16-26, which depend directly or indirectly from claims 1 and 14, respectively, include the features recited in the independent claims as well as additional features, Applicants respectfully submit that claims 2-13 and 16-26 are also patentably distinct over the cited references. Nevertheless, Applicants are not conceding the correctness of the Examiner's rejection with respect to such dependent claims and reserves the right to make additional arguments if necessary.

In view of the amendments and reasons provided above, it is believed that all pending claims are in condition for allowance. The amendments clarify the

patentable invention without adding new subject matter. Applicants respectfully request favorable reconsideration and early allowance of all pending claims.

Respectfully submitted,

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Appendix A
Marked Up Version of the Specification and Entire Claim Set

On page 11, please replace the paragraph beginning on line 7 with:

The present invention provides a method and apparatus that moves data stored in a first (e.g., 512) byte sector format to a second (e.g., 52x which will be used to refer to, for example, 520/524/528) byte sector size. The method and apparatus performs data migration without interruption of the host's ability to write and read data from the system. By migrating data to a number of new drives added to the system drive, the additional data which will be stored may be accommodated. The added drives allow the migration to take place without interruption of the hosts I/O path or allows the data to be migrated to an entirely new set of physical drives.

On page 13, please replace the paragraph beginning on line 12 with:

An actuator assembly 230 is also attached to the base 222. The actuator assembly 230 shown is a rotary type actuator and is provided with a pivot apparatus 232, such as a bearing cartridge, to allow smooth rotation of the actuator assembly. The actuator assembly 230 includes a body 233 having arms 234 on one end. The arms 234 carry transducers 236 in transducing relation to the disk 228. A load beam or suspension 235 is attached to each arm. The transducers 236 are attached to each load beam or suspension 235. The transducers [36] 236 are encapsulated within a slider or small ceramic block. The slider carries the transducer over the disk. The other end of the actuator body 233 includes a portion of an actuator motor. The portion of the actuator motor shown attached to the actuator body 233 is the coil 240. An other portion of the actuator motor is attached to the base 222. The other portion shown in Fig. 2 is a magnetic field apparatus 242. The coil 240 and the magnetic field apparatus 242 form a voice coil motor used to move the actuator body and reposition one or more sliders which carry the transducers 236, also commonly referred to as read/write heads, to different radial positions relative to one or more surfaces of the disk 228. The pivot apparatus 232, such as a precision bearing cartridge, allows for a smooth rotational movement of the actuator assembly [30] 230.

On pages 15, line 21 to page 16, line 15, please replace the paragraphs with:

Read/write electronics 313 receives signals 338 from transducer 308, passes servo information 366 to servo electronics 312, and passes data signals 368 to formatter 315. Servo electronics 312 uses the servo information to produce a current at 340 which controls the voice coil motor 310 to properly position the transducer 308. Interface electronics 314 communicates with a host system (not shown) over interface 362, passing data and command information. Interface electronics 314 also communicates with formatter 315 over interface 364. Microprocessor 316 communicates with the various other electronics over command and data bus 370.

In the operation of disk drive 302, interface electronics 314 receives a request for reading or writing data sectors over interface 362. Formatter electronics 315 receives a list of requested data sectors from interface electronics 314 and converts them into zone, cylinder, head and data sector numbers which uniquely identify the location of the desired data sectors. The head and cylinder information 360 are passed to servo electronics 312, which is responsible for positioning recording head 308 over the appropriate data sector on the appropriate cylinder. If the cylinder number provided to servo electronics 312 is not the same as the track number over which recording head 308 is presently positioned, a seek operation is performed to reposition recording head 308 over the appropriate cylinder.

On page 18, please replace the paragraph beginning on line 6 with:

Fig. 4 illustrates a flow chart 400 of a general embodiment of the invention for migrating data from a first format type to a second format type. Fig. 4 shows that at least one drive is added to the system 410. Then, the data in a first format type on the original drives is converted to a format of second type on the added at least one drive 420. Where the number of available new drives is limited either for cost reasons or simply a lack of physical enclosure slots, an additional physical drive is installed to accommodate the newly added data as described below in more detail with reference to the flow chart 500 of Fig. 5. If there are sufficient drives available to create a "mirror" of the system drive which needs to be migrated, a complete mirror system may be used as described below in more detail with reference to the flow chart 600 of Fig. 6.

On page 18, line 16 to page 19, line 4, please replace the paragraphs with:

In Fig. 5, if an initial configuration uses four physical drives to create a system drive and the data is laid out in 512 byte sectors, an additional physical drive is added to accommodate the newly added data 510. The newly added drive is formatted for 52x sector size. The data is then re-laid (i.e., rearrangement of data within and between drives with no substantive changes to the data) out to utilize five physical drives instead of four [520] 525. The data that is written to the newly added drive will use a 52x sector size, while all of the original drives will retain the 512 byte sector size.

After the data migration has completed, it is now time to convert the original drives to a 52x sector format 530. The conversion process 530 may be performed according to one of two methods 535: through the use of an additional spare drive which is used to migrate 512 byte sector information to 52x byte sector information 540 or through the use of the regenerate() function which will allow the 512 byte information to be rebuilt onto the 52x format 550.

IN THE CLAIMS

Please cancel claim 15 without prejudice or disclaimer and amend claims 1 and 14 as follows:

1. (Amended) A method for migrating data having a first format type to a second format type, comprising:

adding at least one drive to a system controller controlling a predetermined number of storage devices arranged in a digital array storage devices to form a system drive; and

converting data in a first format type on the digital array of storage devices to a format of a second type [on], the converted data being migrated onto the added at least one drive.

2. (Unchanged) The method of claim 1 wherein the adding at least one drive further comprises:

formatting a first drive in the second format type; and

adding the first drive formatted in the second format type to the system drive of the system controller.

3. (Unchanged) The method of claim 2 wherein the converting further comprises:

re-laying out data stored on the predetermined number of storage devices arranged in the digital array storage devices forming the system drive using the predetermined number of storage devices and the added first drive formatted in the second format type;

adding second drive formatted in the second format type to the system controller; and

migrating data of first format type from one of the predetermined number of storage devices to the added second drive in the second format type.

4. (Unchanged) The method of claim 3 wherein the migrating is performed by the system controller using a background process.

5. (Unchanged) The method of claim 4 wherein the system controller performs data writes to both the one of the predetermined number of storage devices and the added second drive during the migration performed by the background process.

6. (Unchanged) The method of claim 3 wherein the one of the predetermined number of storage devices is removed after the migration is completed, an additional drive formatted in the second format type is added in its place and data of the first format type from another of the predetermined number of storage devices is migrated to the additional drive in the second format type.

7. (Unchanged) The method of claim 3 wherein the migrating is performed by the system controller using a regeneration function when the one of the predetermined number of storage devices fails before the migration has completed.

8. (Unchanged) The method of claim 2 wherein the converting further comprises:

re-laying out data stored on the predetermined number of storage devices arranged in the digital array of storage devices forming the system drive using the predetermined number of storage devices and the added first drive formatted in the second format type;

removing one of the predetermined number of storage devices arranged in the digital array of storage devices forming the system drive;

reformatting the removed storage device to the second format type;

reinstalling the reformatted storage device; and

rebuilding data in the first format type onto the reinstalled storage device in the second format type using a regeneration function.

9. (Unchanged) The method of claim 1 wherein the adding at least one drive to a system controller further comprises:

selecting drives to create a mirror system drive; and

formatting the mirror system drive using the second format type.

10. (Unchanged) The method of claim 9 wherein the converting data further comprises copying data from the predetermined number of storage devices arranged in the digital array storage devices in the first format type to the mirror system drive in the second format type.

11. (Unchanged) The method of claim 10 wherein the system controller performs data writes to both the system drive and the mirror system drive during the copying of the data to the mirror system drive.

12. (Unchanged) The method of claim 11 wherein the system drive is removed after completion of the copying process.

13. (Unchanged) The method of claim 11 wherein the first format type is 512 bytes per sector and the second format type consists of one selected from the group comprising 520 bytes per sector, 524 bytes per sector and 528 bytes per sector.

14. (Amended) A storage system, comprising:

a plurality of storage devices forming a system drive, the plurality of storage devices formatted in a first format type;

a system controller, coupled to the plurality of storage devices, for controlling the plurality of storage devices forming the system drive; and

at least one additional drive formatted in a second format type, coupled to the system controller, wherein the system controller converts data in a first format type on the plurality of storage devices to a format of a second type [on], the converted data being migrated onto the at least one additional drive.

16. (Unchanged) The storage system of claim [15] 14 wherein the system controller converts data in a first format type on the plurality of storage devices to a format of a second type on the first drive formatted in the second format type by re-laying out data stored on the plurality of storage devices and the added first drive formatted in the second format type, adding a second drive formatted in the second format type to the system controller; and migrating data of first format type from one of the plurality of storage devices to the added second drive in the second format type.

17. (Unchanged) The storage system of claim 16 wherein the migrating is performed by the system controller using a background process.

18. (Unchanged) The storage system of claim 17 wherein the system controller performs data writes to both the one of the plurality of storage devices and the added second drive during the migration performed by the background process.

19. (Unchanged) The storage system of claim 16 wherein the one of the plurality of storage devices is removed after the migration is completed, an additional drive formatted in the second format type is added in its place and data of the first format type from another of the plurality of storage devices is migrated to the additional drive in the second format type.

20. (Unchanged) The storage system of claim 16 wherein the migrating is performed by the system controller using a regeneration function when the one of plurality of storage devices fails before the migration has completed.

21. (Unchanged) The storage system of claim 15 wherein the system controller converts data in a first format type on the plurality of storage devices to a format of a second type on the first drive formatted in the second format type by re-laying out data stored on the predetermined number of storage devices arranged in the digital array of storage devices forming the system drive using the predetermined number of storage devices and the added first drive formatted in the second format type, removing one of the predetermined number of storage devices arranged in the digital array of storage devices forming the system drive, reformatting the removed storage device to the second format type, reinstalling the reformatted storage device and rebuilding data in the first format type onto the reinstalled storage device in the second format type using a regeneration function.

22. (Unchanged) The storage system of claim 14 wherein the at least one drive further comprises a plurality of additional storage devices arranged to form a mirror system drive, wherein the plurality of additional storage devices arranged to form the mirror system drive are formatted using the second format type.

23. (Unchanged) The storage system of claim 22 wherein the system controller converts data by copying data from the plurality of storage devices in the first format type to the mirror system drive formatted in the second format type.

24. (Unchanged) The storage system of claim 23 wherein the system controller performs data writes to both the system drive and the mirror system drive during the copying of the data to the mirror system drive.

25. (Unchanged) The storage system of claim 24 wherein the plurality of storage devices forming the system drive are removed after completion of the copying process to the mirror drive.

26. (Unchanged) The storage system of claim 14 wherein the first format type is 512 bytes per sector and the second format type consists of one selected from the group comprising 520 bytes per sector, 524 bytes per sector and 528 bytes per sector.